A.D. 1857 . . . . . N° 2335.

SPECIFICATION

OF

CONSTANT JOUFFROY DUMÉRY.

SMOKE-PREVENTING APPARATUS.

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Smoke-preventing Apparatus.

LETTERS PATENT to Constant Jouffroy Duméry, of Paris, in the Empire of France, Civil Engineer, for the Invention of "IMPROVEMENTS IN SMOKE-PREVENTING APPARATUS."

Sealed the 26th February 1858, and dated the 7th September 1857.

PROVISIONAL SPECIFICATION left by the said Constant Jouffroy Duméry at the Office of the Commissioners of Patents, with his Petition, on the 7th September 1857.

I, CONSTANT JOUFFROY DUMÉRY, of Paris, in the Empire of France, Civil Engineer, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN SMOKE-PREVENTING APPARATUS," to be as follows:—

My present Invention, like two former ones, for which Patents were granted to me, and bearing date respectively the Eighteenth of January One thousand eight hundred and fifty-five, and the Twenty-seventh of March One thousand eight hundred and fifty-six, is intended to furnish the description of some varieties of construction leading to the same result, that is to say, to effect the combustion of all combustible materials without smoke by means of the gradual progress of the coal or other combustible material on surfaces which are permeable to the air. I say varieties of construction, because all the elements which I here arrange in different ways are simply and singly described in my former Patents above referred to.

My object in now multiplying the examples is to make it well understood that

my new principle of combustion can be applied to all purposes without distinction. Thus, although the moveable comb or rake—the grate or fixed comb penetrated by the moveable comb—the air uniting with the gases at the moment of their production in a continuous manner—the oblique ascension, that is to say, on inclined planes having grated openings—the principle of the introduction of air at the upper part into apparatus having ascending combustible materials—the lateral feeding in the direction of the smallest axis when the two dimensions are very different, in order to give the combustible a length of passage suitable for the time required for its conversion into coke—and the horizontal pistons, smaller than the channel containing the coal, are individual parts before mentioned or indicated, the arrangement thereof may be varied according to the purpose it is desired to fulfil; I think it well herein to describe some of the numerous variations of which the action or working, according to this principle of combustion, is susceptible.

For this reason, although I have shown how the comb or rake by revolving can cause the coal to ascend by being placed in the interior of a retort, I herein point out that it can render the same service by being placed on the exterior, and so placed, it presents greater facility for disconnecting and overlooking. See its application to the furnace of a locomotive, Fig. 3, Sheet 1. In the one case, as in the other, the feeding takes place so that the combustible material may follow a sufficiently restrained course, in order that the production of coke and its consumption may be equal, whatever be the nature or state of the coal employed.

I have called it a revolving comb or rake in order to render it more intelligible and its functions more simple, but it must be understood that it may act in any other manner than rotatory, and can act either like combs for combing flax, or take an angular motion analogous to that indicated in Fig. 2, Sheet 1.

My revolving comb or rake apparatus offers the advantage of being put and kept in motion without recourse to reverses of movement consequent on the action of the plungers or pistons penetrating into the interior of the introducing channel. I can also obtain this result as indicated at Fig. 2, Sheet 1, in which it suffices to turn the crank in one direction only, in order, by means of the mangle motion, to effect the to-and-fro movement, occupying a shorter time for the return than for the advance.

I will remark that in some cases I arrange the action of the apparatus with grates very slightly inclined, in which I am enabled by the general blending of air and by the feeding taking place at the largest side, and following into the smallest passage. The raising of the grate plays a less important part in

proportion as the temperature is raised, or as the combustible material is less smoky; in this case, my principal auxiliary becomes the lateral feeding, that is to say, the injection of the combustible material through the side or sides of the furnace, which allows of the proportioning of the course or passage of the mass in ignition from the natural state to the state of combustible material, in order to convert it into coke.

In order to give the flame the degree of opacity desired to be obtained, I joint the grates at the part next the exit of the fuel retorts, so as to allow the operator to modify the inclination of the grates during the operation. In other terms, in proportion as the temperature is more active or better, in proportion as the coal is less smoky, I bring my grates nearer the horizontal position; that is to say, there being a certain relation between the width and the height of the fire I can work fire grates which are quite level; it is for this reason I attach so much importance, and that I reiterate so much on that part of my arrangements which consists in causing the fuel to penetrate laterally or better in the direction of the smaller axis, contrary to all means practised before mine; and it is for this reason, that when the smaller axis presents too large dimensions, I divide it into two parts, in order to feed it through both sides.

In one of my former Specifications I indicated the possibility of applying my principles of combustion to metallurgic operations, which require the highest temperatures, by the help of an injection of air at the upper part. This arrangement allows not not only the highest temperatures, but also facilitates the use of combustible materials either too poor or too small to permit easily the passage of air through their mass, in this case my injection of air at the upper part supplies the deficit; and as regards this part of my Invention, it is the principle of the application of the injection of air at the upper part to the ascending coal that constitutes my improvement.

In order that this operation may be attended with greater efficacy I spread a film of air on the whole surface of the furnace; and, in case, if the ashes should be of a nature injurious to the result to be obtained, I direct the nozzle or nozzles in the inverse direction to the draught, making a chamber to receive them, as indicated in Figs. 9, 10, and 11, Sheet 2.

With pure combustible materials which do not produce any scoria, by not sifting through the mass, I can, without inconvenience, cause the coal to ascend vertically and in parallel layers; but with silicious coal, the ashes of which vitrify, the use of inclined planes facilitates the assembling of the scoria in the central line, and renders the cleaning easier.

In order to leave nothing permanently above the ash-pit, as in my former

examples of grates fed by the front, I render the bars moveable in an angular direction, either at their extremity or towards their centre; my charging boxes or chambers are intended to raise each portion of grate, and as soon as the coal contained by the boxes is introduced they are lowered, and the whole cradle is withdrawn, in order to be used in the same way under another neighbouring furnace.

In this manner in all cases in which it is not possible for me to regulate or arrange the course of the combustible by means of lateral feeding, I manage it without leaving any part under the grate.

Wishing to render my method of feeding and maintaining combustion serviceable for all forms of locomotives, a great number being so encumbered laterally as to prevent the possibility of introducing the combustible materials at the sides, I organize means of transport for the fuel from the front and back parts in such case where the construction presents an obstacle to the introduction at the sides.

For this purpose I furnish the fore part of locomotives with a moveable hopper to receive the fuel, letting it descend either on to an endless cloth or into a channel furnished with a conveying screw capable of advancing the fuel towards the retort placed in the fore part of the furnace, and which should feed the front half of the grate, Fig. 6, Sheet 1. Behind I make the retort abut near the door of the furnace, in order to feed the rear half of the fire. In this manner, whatever may be the form of the locomotive, it can be adapted to this new method of combustion.

In order that the upper part of the grate on which the combustion of the fuel is completed, and where it deposits the scoria contained by it, may not be obstructed by this deposit, I give the centre bars an oscillating motion, as seen in Fig. 3, which effectually dislodges the scoria, crumbles it, and allows it to escape through the grate bars in proportion as it is produced, and this, if not entirely, at least the greater portion thereof.

It is unnecessary to add that the plungers or pistons above mentioned may be changed for jointed forcing substances, or even be replaced by the moving of one side of the retort, whenever the volume of the fuel to be supplied will permit of it: see Fig. 5, Sheet 1. The moveable side may also obey obey any other law of motion besides moving round a fixed point, see Fig. 4, Sheet 1. The retort for conducting the fuel can even move entire, as represented at Fig. 13, Sheet 2.

In the different examples which I have just quoted, as well as in those described in my former Specifications, it is easy to understand, that by uniting the right-hand forcers with the left-hand ones by two lateral rods, it will suffice

to give motion to one of them in order that both may move simultaneously and in inverse directions, that is to say, one withdrawing while the other Pushes, as seen in Fig. 12, Sheet 2.

Description of Drawings.

Sheet 1.—Fig. 1, section of a furnace with articulated or jointed rakes or combs. A, blades or teeth of a rake or comb: B, frame, serving to unite the teeth of the comb together; C, jointed lever, allowing the comb-carrying frame to describe the curve C, C′; D, D, crank shaft, allowing the comb-carrying frame to assume all the positions contained between *a*, *a′*, *a″*, in the direction indicated by the arrows, and to return by a way analogous to the form of the bar.

Fig. 2, example of pusher or thrust piece, having an alternating motion with a continuous rotary motor. A, rack; B, pinion, having an alternating motion; C, mangle wheel, gearing on the interior and exterior; D, motive pinion, having continuous rotary motion gearing alternately with the interior and exterior teeth of C.

Fig. 3, transverse section, in elevation, of a furnace of a locomotive furnished with revolving combs or rakes. A, hopper for introducing the fuel; B, revolving comb or rake; C, bars between which the combs move; D, bars without motion, on which the fire ascends; E, oscillating bars, receiving their oscillatory motion from the portion of the circle F; F, portion of a circle, in the slots *f* of which the levers *e*, *e*, of bars E are held. Oscillatory motion is transmitted by a rod to the portion of the circle F, which it receives from a crank shaft, which receives its motion from the shaft of the tender. A shaft is adapted for giving motion by hand to the comb-carrying shaft by means of bevil wheels, which transmit the motion to a screw shaft which gears with a screw wheel, keyed on the shaft of the revolving combs; another shaft communicates motion like the last-mentioned shaft to the whole system of apparatus, which motion it receives from the axle of the tender.

Fig. 4, illustration of an angular pushing or feeding surface, which is free to rise at the upper part in order to follow the course prescribed at the lower part. A, channel for the introduction; B, pusher, secured by the joint C to the lever D, and sliding between a slot at E; C, joint, rendering the pusher B dependent on the curve described by the lever D; D, lever pivoted at *d′*; E, slot, into which the pusher B slides vertically; F, crank shaft, giving motion to the whole system, either by means of two rods or by means of the crank pins sliding in the slots of the two levers G; G, levers, with slots for transforming the circular motion of the shaft into an alternating motion.

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Fig. 5, section of a furnace having an angular pusher, with a hand lever as a motor. A, channel for the introduction of the fuel; B, bars or grate, on which the combustion is accomplished; C, presser or hinged pannel, for thrusting the fuel forwards; D, lever, actuating the presser; E, axis or hinge of the lever and of the presser.

Fig. 6, section of a locomotive, fed in front and from behind. A, hopper or reservoir of fuel; B, horizontal screw, transporting the coal from the front to the back; C, channel of introduction conducting the combustible material to the revolving combs; D, revolving combs; E, channel for the introduction of fuel at the back of the furnace; F, grate for furnace bars.

Sheet 2.—Figs. 7 and 8, plan view of the propelling wedges, manœuvred either by any motive power or by hand. A, acting rod; B, single wedge, if the furnace is composed of one compartment only; and B′, duplicate wedges, if the furnace possesses several compartments; *c* and *c′*, rack screw, or any other motor, for giving motion to the wedges.

Fig. 9, transverse section of the fire-place of a reverberatory furnace; Fig. 10 longitudinal section of the same furnace; Fig. 11, horizontal section above the fire bridge. Note.—In these three Figures similar letters indicate like parts. A, grate or bars; B, revolving combs, for feeding the furnace; C, fire bridge; D, pipes or nozzles, for admitting hot or cold air; E, counter fire bridge separating a chamber for receiving the ashes lifted by the current of air; F, chamber receiving the ashes; G, doors shutting the ash-pit.

Fig. 12, illustration of the simultaneous moving of the two pushers operated by a single movement. A, left-hand pusher; B, right-hand pusher; C, rod, connecting the two opposite pushers exterior of the furnace; D, crank shaft, actuating the pushers and producing in them a simultaneous alternating motion; E, rod connecting shaft D to rod C.

Fig. 13, illustration of the propulsion of the combustible by the moving of the retort. A, feeding retort hinged at the point *a*; B, hopper or fixed part for the introduction of the combustible material; C, point of attachment of the rod or lever which transmits the motion; D, fixed part or channel in which the moveable part A moves.

Fig. 14, section of a furnace having openings for charging in the direction of its length; Fig. 15, section of the same furnace, with the cradle carrying the charging boxes withdrawn. Note.—In these two Figures similar letters indicate like parts. A, fire bridge; B, portion of the grate (fixed or articulated) for receiving the scoria; C, anterior part, moving on joints if required; D, D′, D″, different stages of the grate pivotted at *d*, *d′*, *d″*; E, cradle, carrying the charging boxes, it is mounted on rollers *e*; F, charging

boxes, jointed at *f*; G, pistons or pushers, jointed at *g*; H, rack connected to all the charging boxes F by the joints *f*, in order to make all the pushers advance simultaneously; I, I′, I″, I‴, levers jointed at *i*, *i*′, *i*″, *i*‴, and connected to the other levers; J, acting handle of the first lever I; K, rod joining the levers I, I′, I″, I‴, together by means of joints *i*, *i*′, *i*″, *i*‴, and producing in them a simultaneous motion; L, lid of charge-carrying boxes articulated at *l*; M, fixed parts concentric with the centres of articulation *d*, *d*′, *d*″; they are permanently fixed to the frame E of the cradle carrying the charging boxes; N, pinion shaft and hand wheel, communicating motion to the rack H. The action of this apparatus is easy to understand as the result from the preceding description; the cradle being withdrawn, as at Fig. 15, the lids *l* are opened, each box is filled with fuel, when the lids are lowered and shut; the several parts being in this state the cradle is advanced under the grate or furnace bed, and when it is in its place and fixed by any suitable stop catch, the handle J of the first lever is lowered, which communicates motion to all the others, and lifts all the charging boxes to the inclined position seen at *x*, Fig. 15, and produces the same movement of inclination in all the stages of the furnace grate, as seen at *x*′, Fig. 14. The grate bars being lifted, the pushers G are advanced by means of the wheel and pinion N, which discharges the contents of the boxes into the furnace, and it only remains to operate the same movement in the inverse direction in order that the furnace may be free.

I have multiplied the examples of the various methods of carrying out this new principle of combustion in order to show, firstly, that it is of a nature to afford the most varying applications, and also that it is on the base, on the principle, on the mode of action of the combustible elements, that my Invention rests, much more than on the material agent serving to effect it.

I will further remark, firstly, the principal features of the present Invention rest on the principle of the progression of the combustible material on fixed surfaces permeable to atmospheric air, permitting continuity of action of all the parts necessary to the complete combustion, without liability of becoming deranged, whatever may be the weight and number of charges of the fuel; secondly, the feeding operated by ways sufficiently short to permit of the regulating and equalizing the production and consumption of coke, of however smoky a nature the combustible material may be.

Note.—One furnace may be substituted for another either by transposition of the parts among themselves, or according to the varying character of the object to be effected.

Duméry's Improvements in Smoke-preventing Apparatus.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Constant Jouffroy Duméry in the Great Seal Patent Office on the 5th March 1858.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, CONSTANT JOUFFROY DUMÉRY, of Paris, in the Empire of France, Civil Engineer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Seventh day of September, in the year of our Lord One thousand eight hundred and fifty-seven, in the twenty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Constant Jouffroy Duméry, Her special licence that I, the said Constant Jouffroy Duméry, my executors, administrators, and assigns, or such others as I, the said Constant Jouffroy Duméry, executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN SMOKE-PREVENTING APPARATUS," upon the condition (amongst others) that I, the said Constant Jouffroy Duméry, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Constant Jouffroy Duméry do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the three Sheets of Drawings hereunto annexed, and to the letters and figures marked thereon (that is to say):—

My present Invention, like two former ones for which Patents were granted to me, and bearing date respectively January the Eighteenth, One thousand eight hundred and fifty-five, and March the Twenty-seventh, One thousand eight hundred and fifty-six, is intended to furnish the description of some varieties of construction leading to the same result, that is to say, to effect the combustion of all combustible materials without smoke by means of the gradual progression of the coal or other combustible material on surfaces which are permeable to the air. I say varieties of construction, because all

the elements which I here arrange in different ways are simply and singly described in my former Patents above referred to.

My object in now multiplying the examples is to make it well understood that my new principle of combustion can be applied to all purposes without distinction. For instance, the moveable comb or rake—the grate bars or fixed comb penetrated by the moveable comb—the air uniting with the gases at the moment of their production in a continuous manner—the oblique ascension, that is to say, the ascension on inclined planes, having grated openings—the principle of the introduction of air at the upper part into apparatus, having ascending combustible materials—the lateral feeding in the direction of the smaller axis when the two dimensions are very different, in order to give the combustible a length of passage suitable for the time required for its conversion into coke—and the horizontal pistons, smaller than the channel containing the coal, are elements which have been indicated heretofore, still the arrangement thereof may be varied according to the purpose it is desired to fulfil; I think it well herein to describe some of the numerous variations of which the action or working, according to this principle of combustion, is susceptible.

For this reason, although I have shown how the comb or rake by revolving can cause the coal to ascend by being placed in the interior of a retort, I herein point out that it can render the same service by being placed on the exterior, and so placed, it presents greater facility for disconnecting and overlooking. See its application to the furnace of a locomotive, Fig. 3, Sheet 1. In the one case, as in the other, the feeding takes place so that the combustible material may follow a sufficiently restricted course, in order that the production of coke and its consumption may be equal, whatever be the nature or state of the coal employed.

I have called it a revolving comb or rake in order to render it more intelligible, and cause its functions to appear more simple, but it must be understood that it may act in any other manner other than rotatory, and can act either like combs for combing flax, or take any angular motion analogous to that indicated in Fig. 1, Sheet 1.

My revolving comb or rake apparatus offers the advantage of being put and kept in motion without recourse to reverses of movement consequent on the action of the plungers or pistons penetrating into the interior of the introducing channel. I can also obtain this result as indicated at Fig. 2, Sheet 1, in which it suffices to turn the crank in one direction only, in order, by means of the mangle motion, to effect the to-and-fro movement occupying a shorter time for the return than for the advance.

I will remark that in some cases I arrange the action of the apparatus

with grates very slightly inclined, in which I am enabled, by the general blending of air, and by the feeding taking place at the widest side, and the fuel entering by a short passage. The raising of the grate plays a less important part in proportion as the temperature is raised, or as the combustible material is less smoky; in this case, my principal auxiliary becomes the lateral feeding, that is to say, the injection of the combustible material through the side or sides of the furnace, which allows of the proportioning of the course or passage of the mass in ignition, either in the natural state, or in a state of fuel, in order to convert it into coke.

In order to give the flame the degree of opacity desired to be obtained, I joint the grates at the part next the exit of the fuel retorts, so as to allow the operator to modify the inclination of the grates during the operation. In other terms, in proportion as the temperature is more active, or in proportion as the coal is less smoky, I bring my grates nearer the horizontal position, that is to say, there being a certain relation between the width and the height of the fire, I can even work fire grates which are quite level; it is for this reason I attach so much importance, and that I insist so much on that part of my arrangements which consists in causing the fuel to penetrate laterally, or better, in the direction of the smaller axis, contrary to all means practised before mine, and it is for this reason that when the smaller axis presents too large dimensions I divide it into two parts, in order to feed it through both sides.

In one of my former Specifications I indicated the possibility of applying my principles of combustion to metallurgic operations which require the highest temperatures, by the help of an injection of air at the upper part. This arrangement allows not only the reaching of the highest temperatures, but also facilitates the use of combustible materials too poor and too small to permit easily the passage of air through their mass; in this case my injection of air at the upper part supplies the deficit, and as regards this part of my Invention, it is the principle of the application of the injection of air at the upper part to the ascending coal that constitutes my improvement. In order that this operation may be attended with greater efficacy, I spread a film of air on the whole surface of the furnace, and in case the ashes should be of a nature injurious to the result to be obtained, I direct the nozzle or nozzles in the inverse direction to the draught, making a chamber to receive them, as indicated in Figs. 9, 10, and 11, Sheet 2.

With pure combustible materials which do not produce any scoria by not sifting the air through the mass, I can, without inconvenience, cause the coal to ascend vertically and in parallel layers; but with silicious coal, the ashes of

which vitrify, the use of inclined planes conduces to the assembling of the scoria in the central line, and renders the cleaning easier.

In order to leave no permanent encumbrance about the ash-pit, as in my former examples of grates fed by the front, I render the bars moveable in an angular direction, either at their extremity or towards their centre; my charging boxes or chambers are intended to raise each portion of grate, and as soon as the coal contained by the boxes is introduced they are lowered, and the whole cradle is withdrawn in order to be used in the same manner under another neighbouring furnace.

In this manner, in all cases in which it is not possible for me to regulate or arrange the course of the combustible material by means of lateral feeding, I manage it without leaving any part of the apparatus under the grate.

Wishing to render my method of feeding and maintaining combustion serviceable for all forms of locomotives, a great number of which are so encumbered laterally as to prevent the possibility of introducing the combustible materials at the sides, in this case I organise means of transport for the fuel from the front to the back part, so as to allow of the fuel being fed both at back and in front.

For this purpose I furnish the fore part of locomotives with a moveable hopper to receive the fuel, letting it descend either on to an endless cloth or into a channel furnished with a conveying screw capable of advancing the fuel towards the retort placed in the fore part of the furnace, and which should feed the front half of the grate: see Fig. 6, Sheet 1. Behind, I make the retort abut near the door of the furnace in order to feed the rear half of the fire. In this manner, whatever may be the form of the locomotive, it can be adapted to this new method of combustion.

In order that the upper part of the grate on which the combustion of the fuel is completed, and where it deposits the scoria contained by it, may not be obstructed by this deposit, I give the centre bars an oscillating motion, as seen in Fig 3, Sheet 1, which effectually dislodges the scoria, crumbles it, and allows it to escape through the grate bars in proportion as it is produced, and this, if not entirely, at least the greater portion thereof.

It is unnecessary to add, that the plungers or pistons above-mentioned may be changed for jointed forcing surfaces, or even be replaced by the moving of one side of the retort whenever the volume of the fuel to be supplied will permit of it, see Fig. 5, Sheet 1. The moveable side may also obey any other law of motion besides moving round a fixed point, see Fig. 4, Sheet 1. The retort for conducting the fuel can of itself move as represented at Fig. 13, Sheet 2.

Duméry's Improvements in Smoke-preventing Apparatus.

In the different examples which I have just quoted, as well as in those described in my former Specifications, it is easy to understand, that by uniting the right-hand forcers with the left-hand ones by two lateral rods, it will suffice to give motion to one of them in order that both may move simultaneously and in inverse directions, that is to say, one withdrawing while the other pushes, as seen in Fig. 12, Sheet 2.

Description of Drawings.

Sheet 1.—Fig. 1, section of a furnace, with articulated or jointed rakes or combs. A, blades or teeth of a rake or comb; B, frame, serving to unite the teeth of the comb together; C, jointed lever, allowing the comb-carrying frame B to describe the curve C, C′; D, D, crank shafts, allowing the comb-carrying frame to assume all the positions contained between *a*, *a′*, *a″*, in the direction indicated by the arrows, and to return by a way analogous to the form of the bar.

Fig. 2, example of pusher or thrust piece, having an alternating motion with a continuous rotary motor. A, rack; B, pinion, having an alternating motion; C, mangle wheel, gearing on the interior and exterior; D, motive pinion, having continuous rotary motion gearing alternately with the interior and exterior teeth of C.

Fig. 3, transverse section, in elevation, of a furnace of a locomotive, furnished with revolving combs or rakes. A, hopper for introducing the fuel; B, revolving comb or rake; C, bars between which the combs move; D, bars without movement on which the fire ascends; E, oscillating bars, receiving their oscillatory motion from the portion of the circle F; F, portion of a circle in the slots *f*, of which the levers *e*, *e*, of bars E are held; M^1, shaft, carrying the revolving combs or rakes.

Fig 4, illustration of an angular pushing or feeding surface, which is free to rise at the upper part in order to follow the course prescribed at the lower part. A, channel for the introduction of the fuel; B, pusher, secured by the joint C to the lever D, and sliding in a slot at E; C, joint, rendering the pusher B dependent on the curve described by the lever D; D, lever pivotted at *d′*; E, slot into which the pusher B slides vertically; F, crank shaft, giving motion to the whole system, either by means of two rods, or by means of the crank pins sliding in the slot of the two levers G; G, levers with slots for transforming the circular motion of the shaft F into an alternating motion.

Fig. 5, section of a furnace having an angular pusher, with a hand lever as a motor. A, channel for the introduction of the fuel; B, bars or grate on which the combustion is accomplished; C, presser or hinged pannel for thrust-

ing the fuel forwards; D, lever actuating the presser; E, axis or hinge of the lever and of the presser.

Fig. 6, section of a locomotive, fed in front and from behind. A, hopper or reservoir of fuel; B, horizontal screw transporting the coal from the front to the back; C, channel of introduction conducting the combustible material to the revolving combs; D, revolving combs; E, channel for the introduction of fuel at the back of the furnace; F, grate or furnace bars.

Sheet 2.—Figs. 7 and 8, plan view of the propelling wedges manœuvred either by any motive power or by hand; A, acting rod; B, single wedge, if the furnace is composed of one compartment only, and B′, duplicate wedges, if the furnace possesses several compartments; C and C′, rack, screw, or any other motor, for giving motion to the wedges.

Fig. 10, transverse section of the fire-place of a reverberatory furnace; Fig. 9, longitudinal section of the same furnace; Fig. 11, horizontal section above the fire bridge. Note.—In these three Figures similar letters indicate like parts. A, grate or bars; B, revolving combs for feeding the furnace; C, fire bridge; D, pipes or nozzles for introducing hot or cold air; E, counter fire bridge, separating a chamber for receiving the ashes, lifted by the current of air; F, chamber receiving the ashes; G, doors shutting the ash-pit.

Fig. 12, illustration of the simultaneous moving of the two pushers operated by a single movement. A, left-hand pusher; B, right-hand pusher; C, rod, connecting the two opposite pushers, exterior of the furnace; D, crank shaft, actuating the pushers and producing in them a simultaneous alternating motion; E, rod, connecting shaft D to rod C.

Fig. 13, illustration of the propulsion of the combustible material by the moving of the retort; A, feeding retort hinged at the point *a*; B, hopper or fixed part for the introduction of the combustible material; C, point of attachment of the rod or lever which transmits the motion; D, fixed part or channel in which the moveable part A moves.

Fig. 14 section of a furnace having openings for the charging in the direction of its length. Fig. 15, section of the same furnace, with the cradle carrying the charging boxes withdrawn. Note.—In these two Figures similar letters indicate like parts. A, fire bridge; B, portion of the grate (fixed or articulated) for receiving the scoria; C, front part moving on joints, if required; D, D′, D″, different stages of the grate pivotted at *d*, *d′*, *d″*; E, cradle carrying the charging boxes; it is mounted on rollers *e*; F, charging boxes jointed at *f*; G, pistons or pushers jointed at *g*; H, rack connected to all the pushers G by the joints F, in order to make all the pushers advance simultaneously; I, I′, I″, I‴, levers jointed at *i*, *i′*, *i″*, *i‴*,

and connected to the other levers; J, acting handle of the first lever I; K, rod joining the levers I, I′, I″, I‴, together by means of joints *i*, *i′*, *i″*, *i‴*, and producing in them a simultaneous motion; L, lid of charge-carrying boxes articulated at *l*; M, fixed parts concentric with the centres of articulation *d*, *d′*, *d″*; they are permanently fixed to the frame E of the cradle carrying the charging boxes; N, pinion shaft and hand wheel, communicating motion to the rack H; the action of this apparatus is easy to understand, as the result from the preceding description; the cradle being withdrawn, as at Fig. 15, the lids L are opened, each box is filled with fuel, the lids are then lowered and shut; the several parts being in this state the cradle is advanced under the grate or furnace bed, and when it is in its place and fixed by any suitable stop catch the handle J, of the first lever I, is lowered, which communicates motion to all the others, and lifts all the charging boxes to the inclined position seen at *x*, Fig. 15, and produces the same movement of inclination in all the stages of the furnace grate as seen at *x′*, D′, Fig. 14. The grate bars being lifted, the pushers G are advanced by means of the wheel and pinion N, which discharges the contents of the boxes into the furnaces, and it only remains to operate the same movement in the inverse direction, in order that the furnace may be free.

Sheet 3.—Fig. 16 is a front elevation; Fig. 17, transverse section; Fig. 18, horizontal section; and Fig. 19, longitudinal section of a furnace for Woolf's generator. Note.—In these four Figures similar letters of reference indicate like parts where they recur. A, cylindrical steam boiler; B, fixed bars; C, moveable bars, which are removed for drawing the fire; D, hopper in which the fuel is placed; E, channels for conducting the fuel on to the grate; F, valve jointed at *f*, it pushes the fuel at each oscillatory motion; G, rods, actuating the valves; H, rod, receiving motion from a crank shaft put in motion by wheel gear; I, lever, transmitting motion from rod H to rods G; J, fire doors; K, ash-pit doors.

I have multiplied the examples of the various methods of carrying out this new principle of combustion in order to show, firstly, that it is of a nature to afford the most varying applications, and also, that it is on the base, on the principle, on the mode of action of the combustible elements, that my Invention rests, much more than on the material agent serving to effect it.

I will further remark, first, the principal elements or features of the present Invention rest on the principle of the progression of the combustible material on fixed surfaces permeable to atmospheric air, permitting continuity of action necessary to complete combustion without liability of disturbance, whatever may be the weight and number of charges of the fuel.

Duméry's Improvements in Smoke-preventing Apparatus.

Secondly, the progression of the fuel effected through a sufficiently short passage, to allow of the equalization of the production and consumption of coke, whatever may be the nature of the coal employed.

Note.—One fire-place may be substituted for another, either by the transposition of the parts among themselves or according to the variety of purpose intended.

In witness whereof I, the said Constant Jouffroy Duméry, have hereunto set my hand and seal this Third day of March, in the year of our Lord One thousand eight hundred and fifty-eight.

C. J. DUMÉRY. (L.S.)

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FIG. 1.

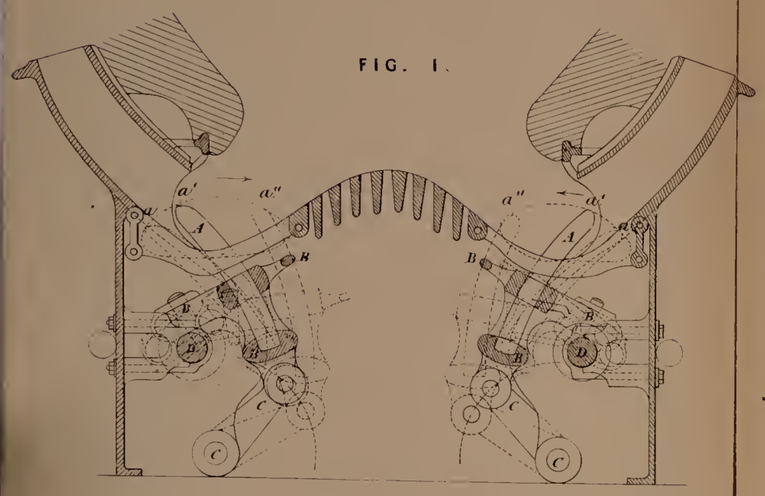
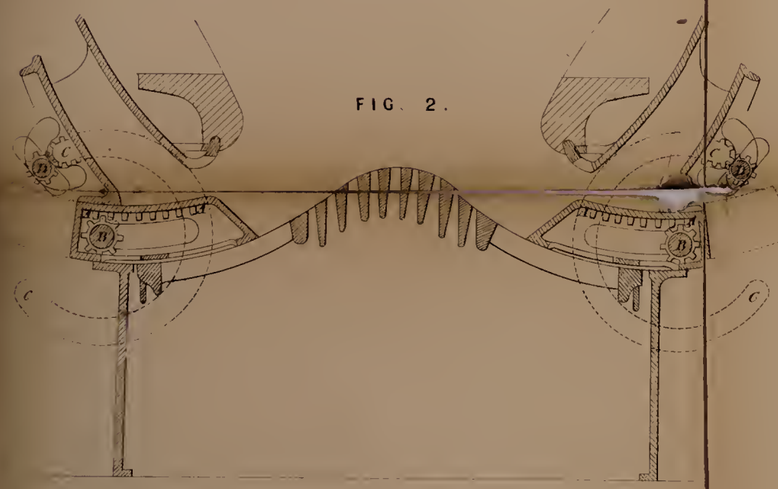


FIG. 2.



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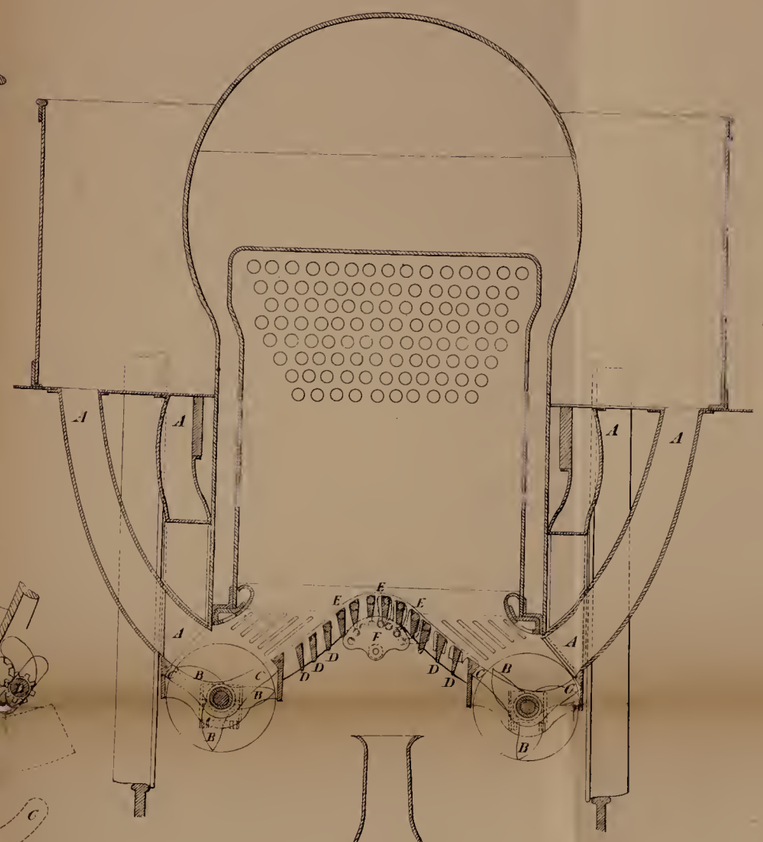

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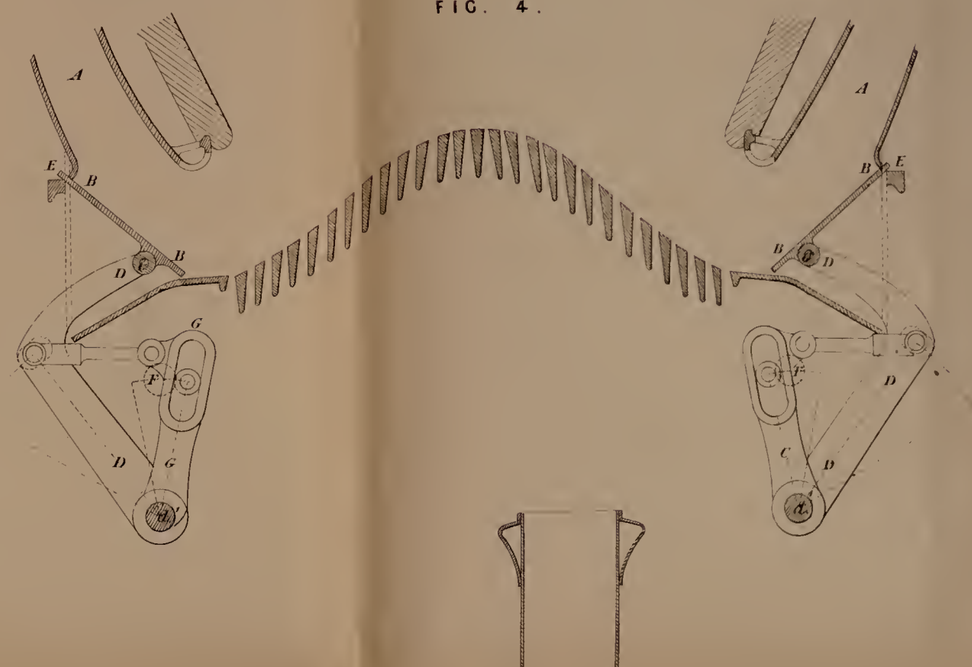

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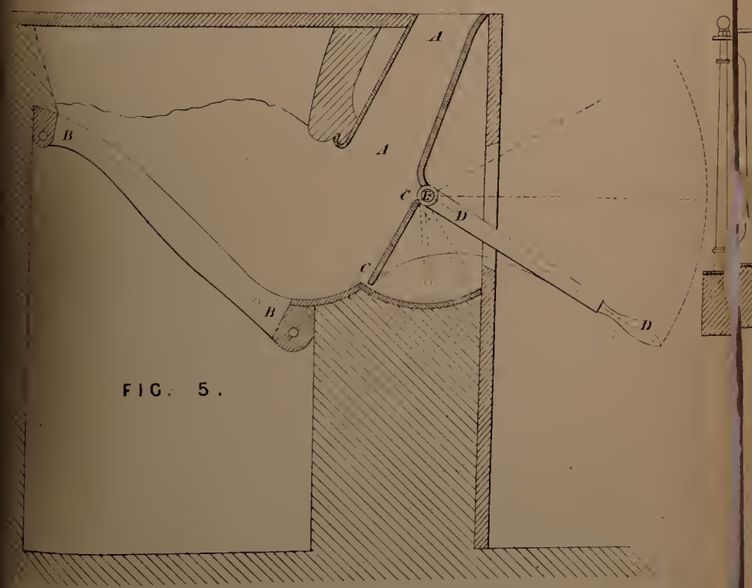

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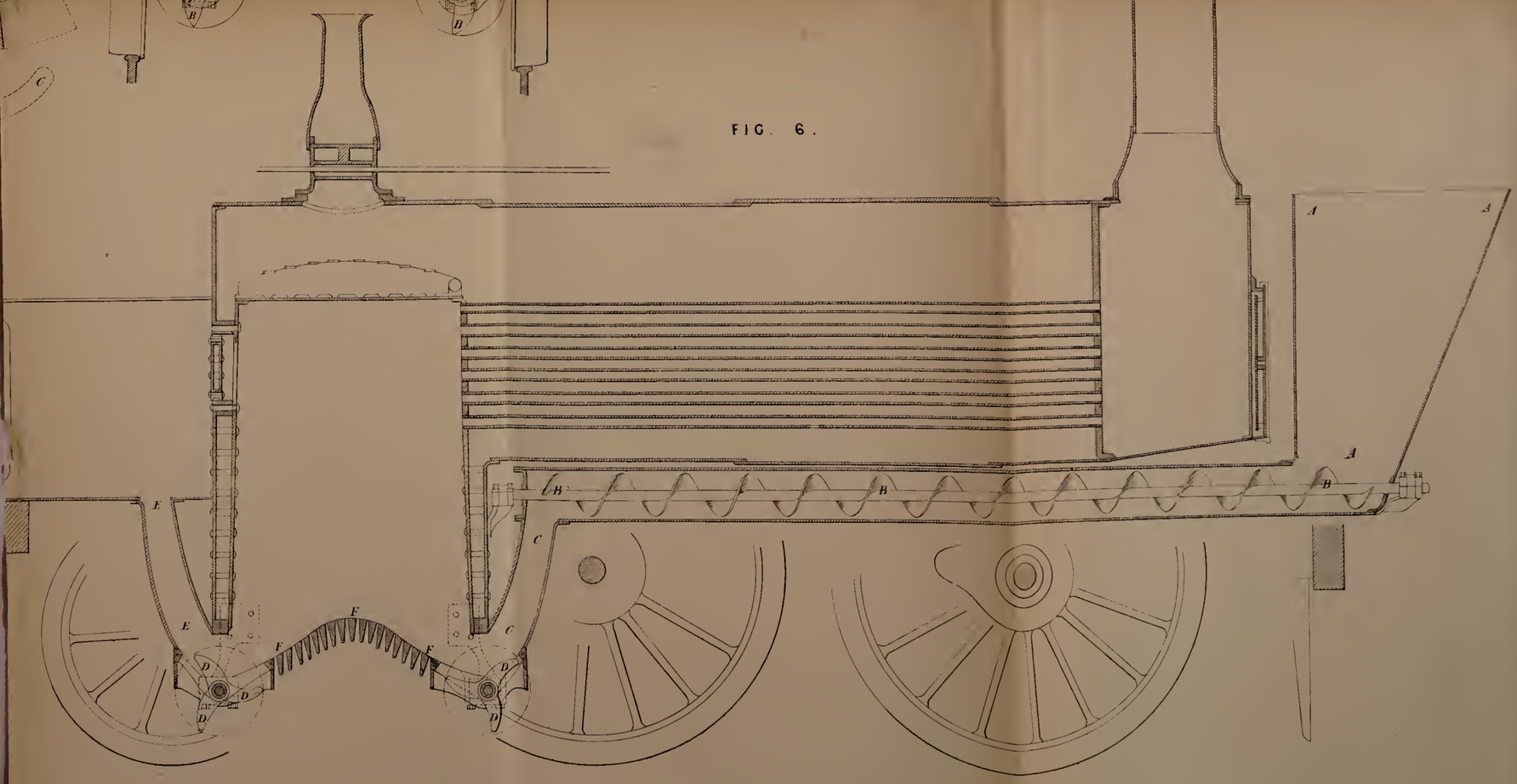

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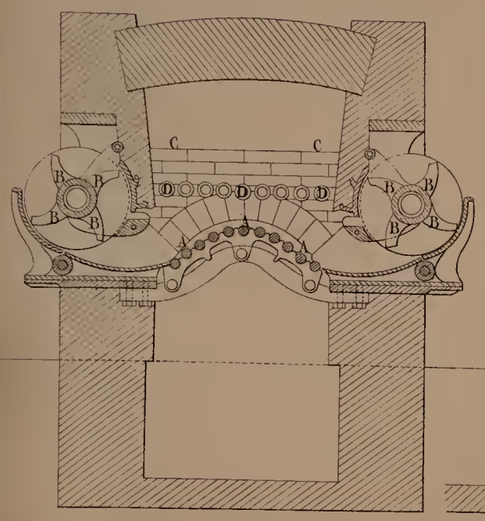
FIG. 9.



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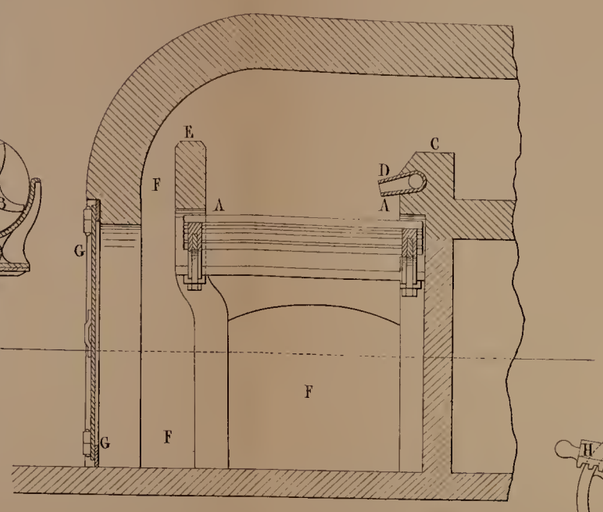

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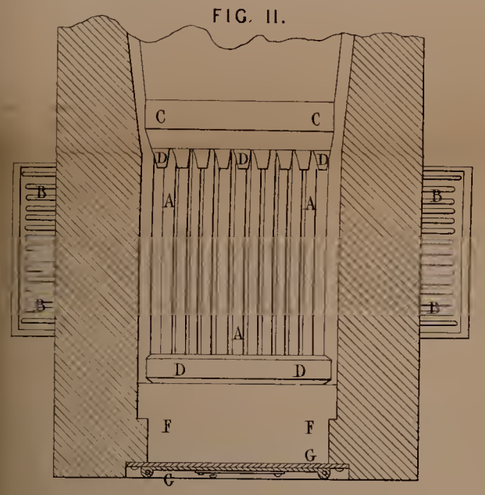

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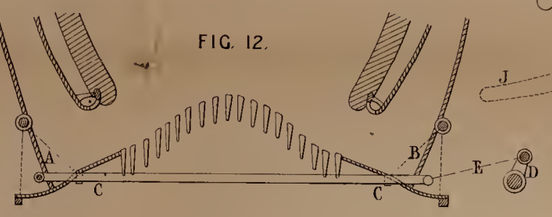

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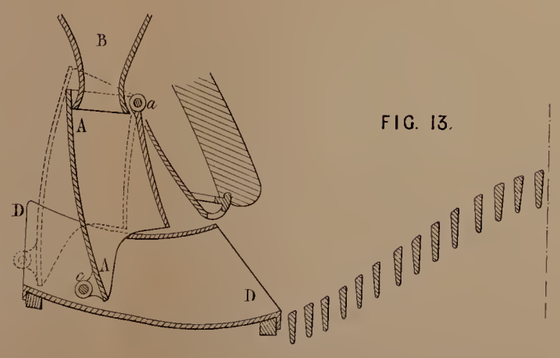

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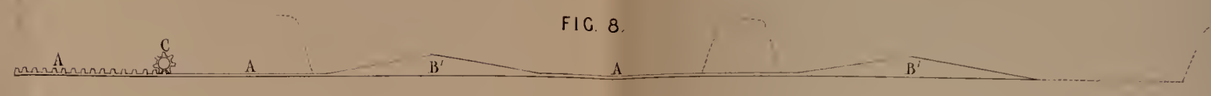

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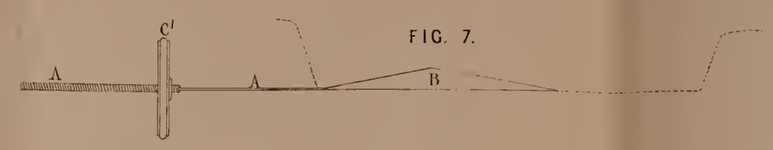

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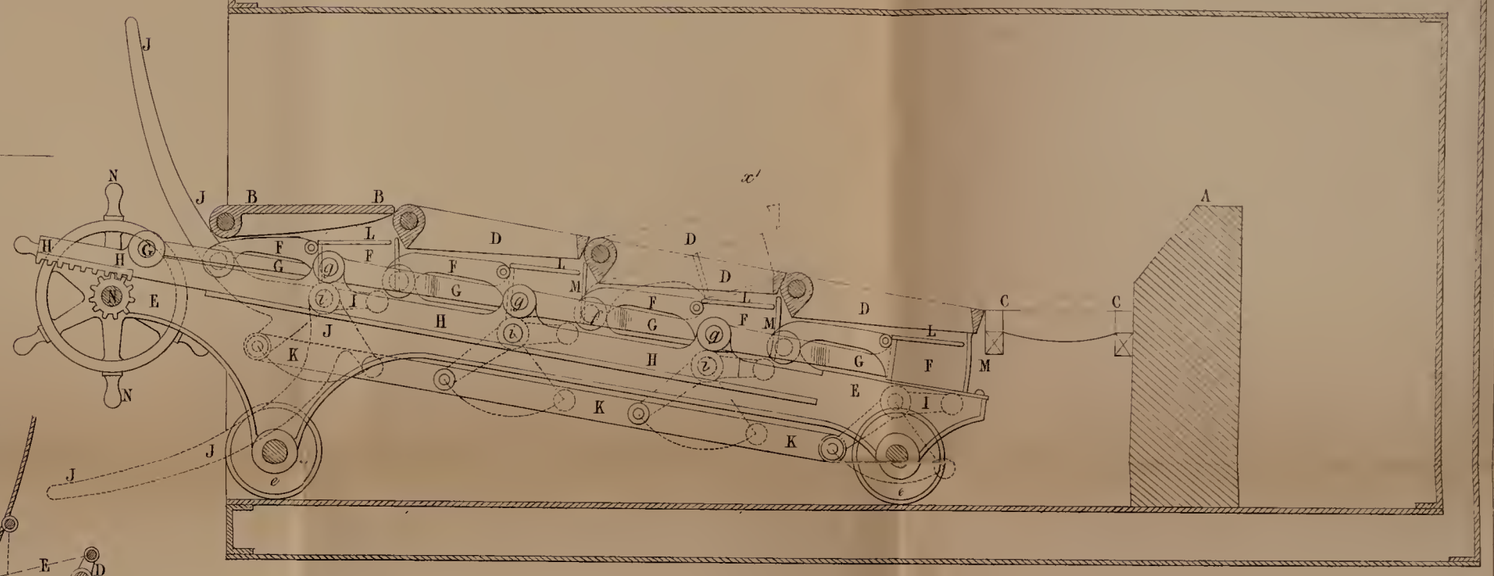

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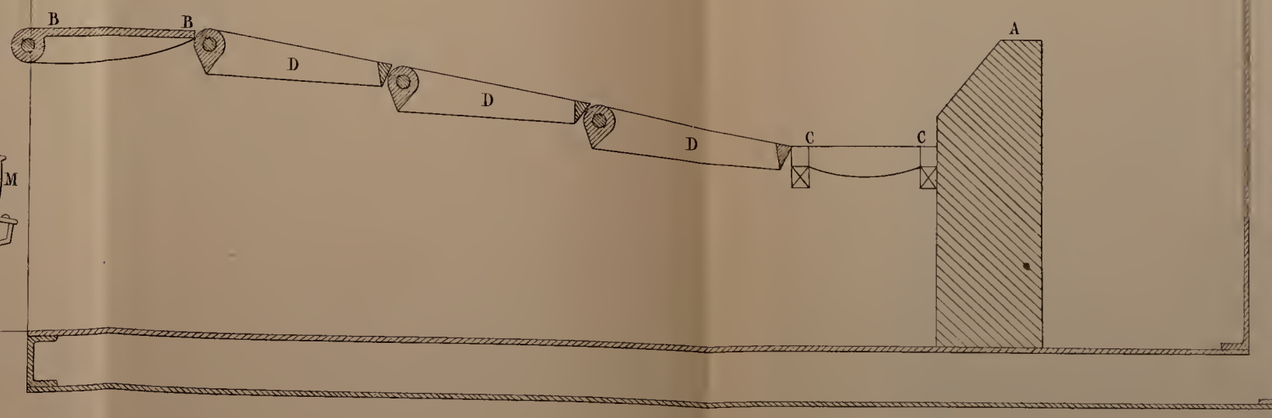

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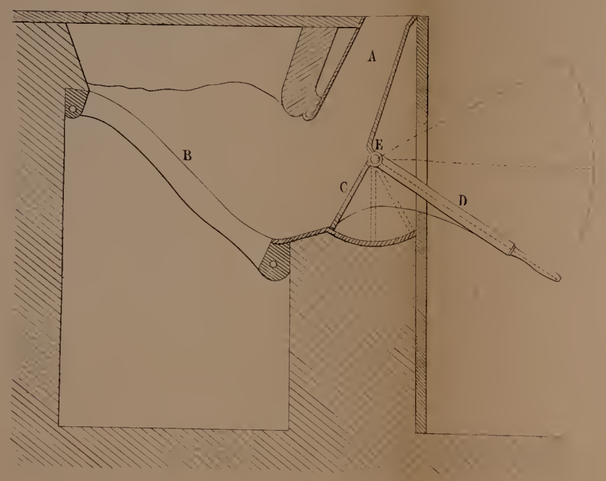
FIG. 5.



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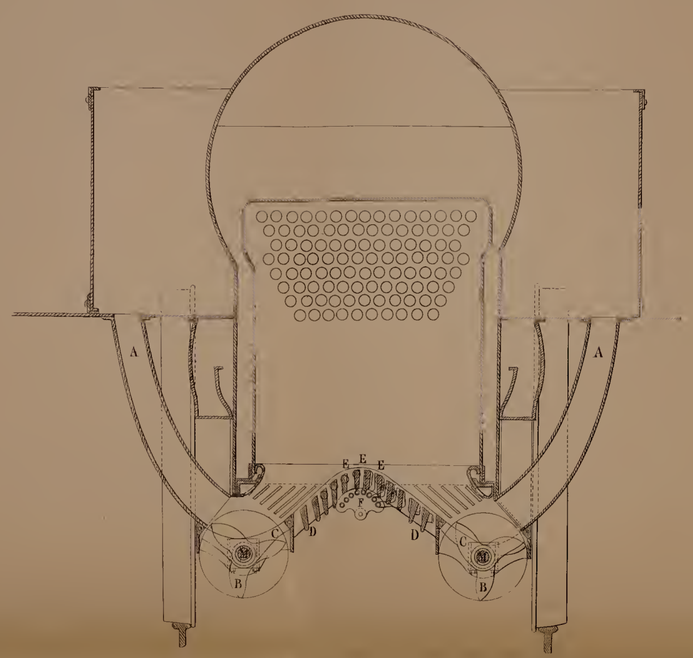

FIG. 4.

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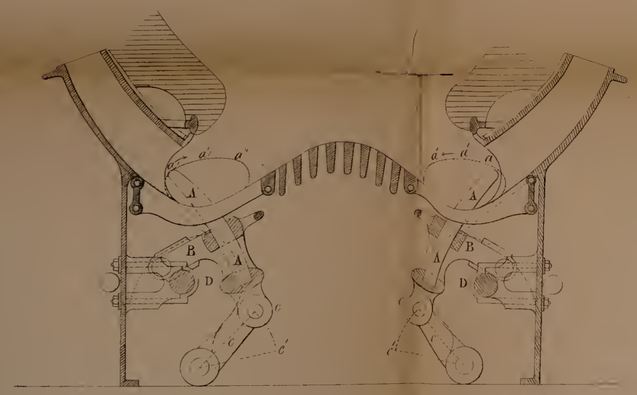

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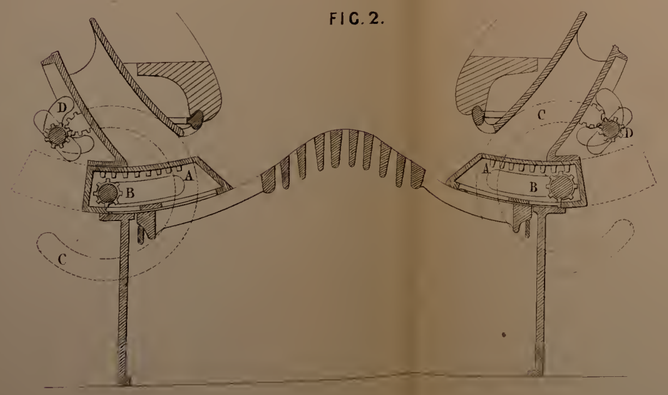

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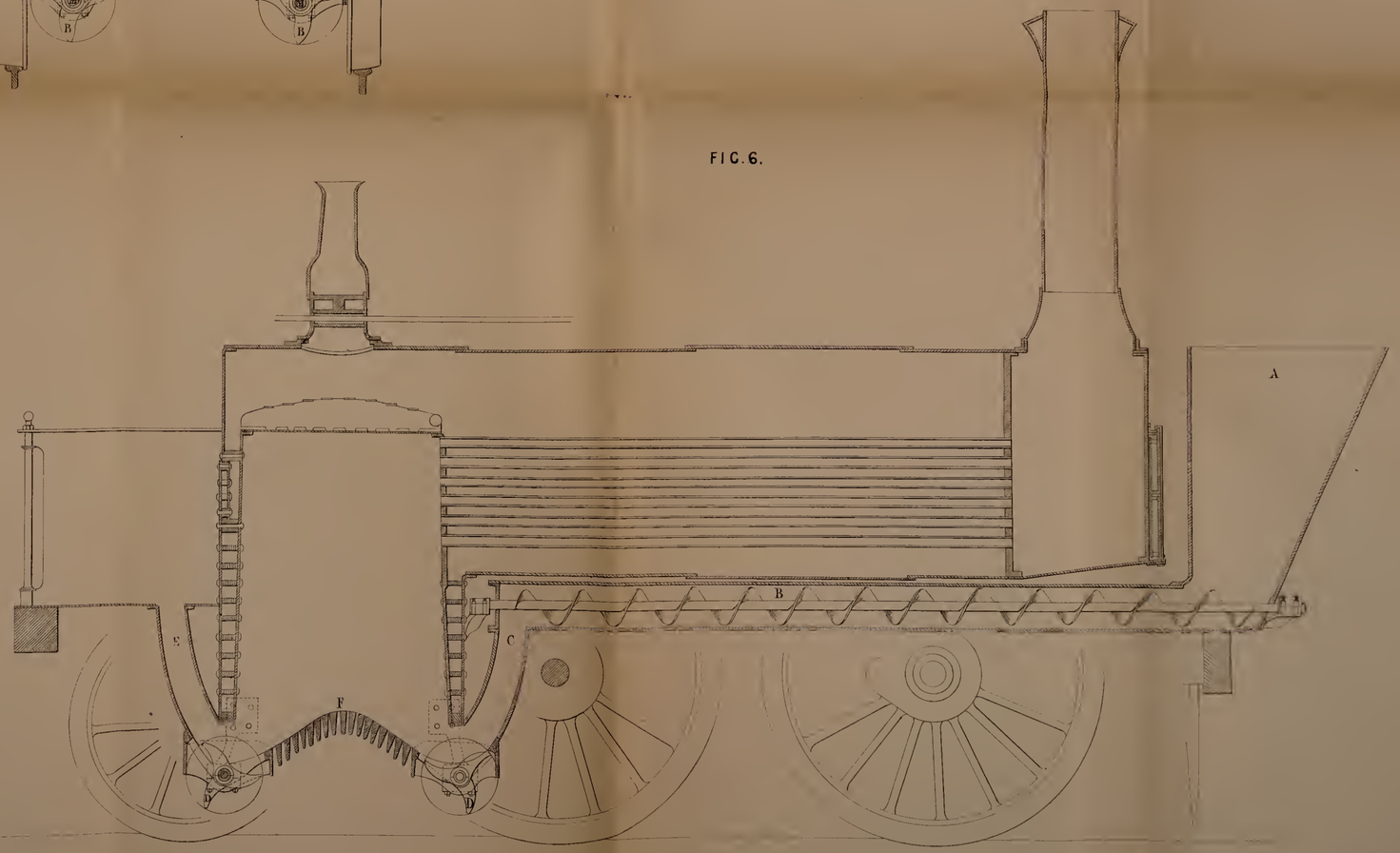

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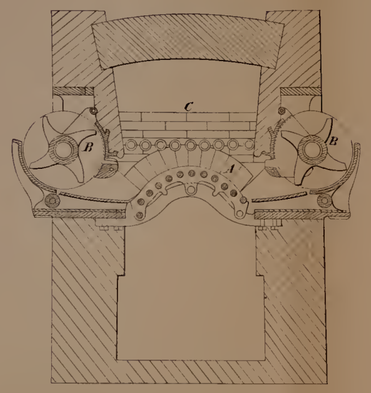
FIG. 10.



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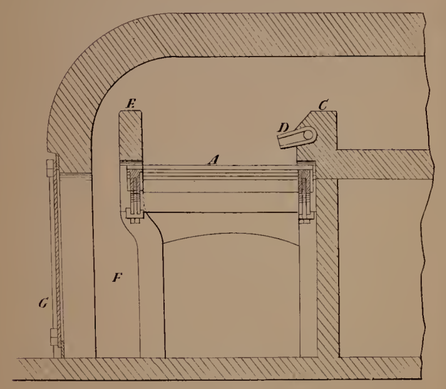

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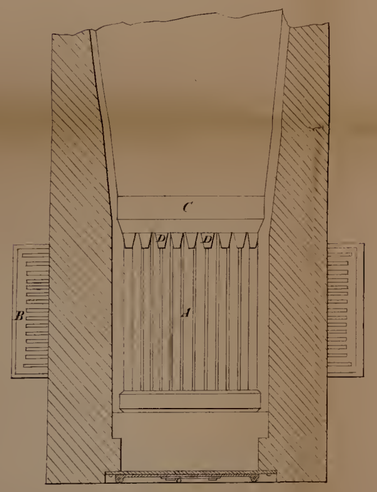

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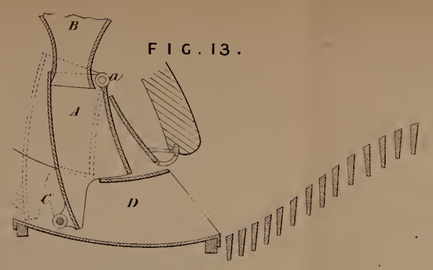

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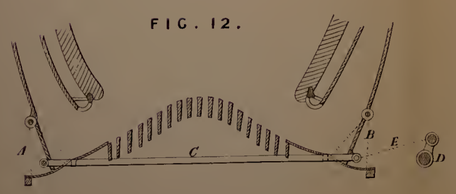

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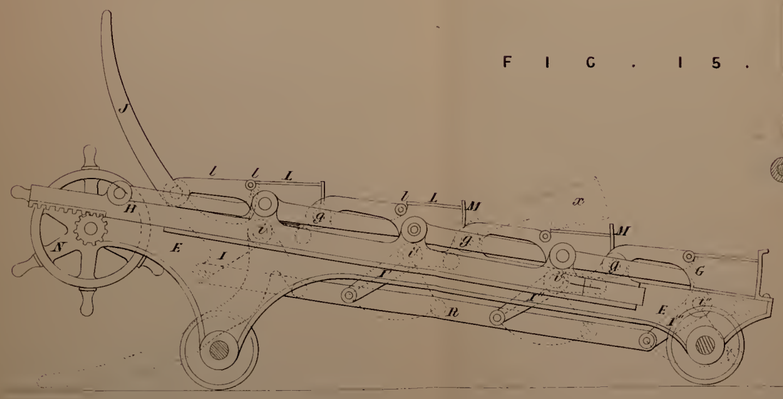

FIG. 7.

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FIG. 8.

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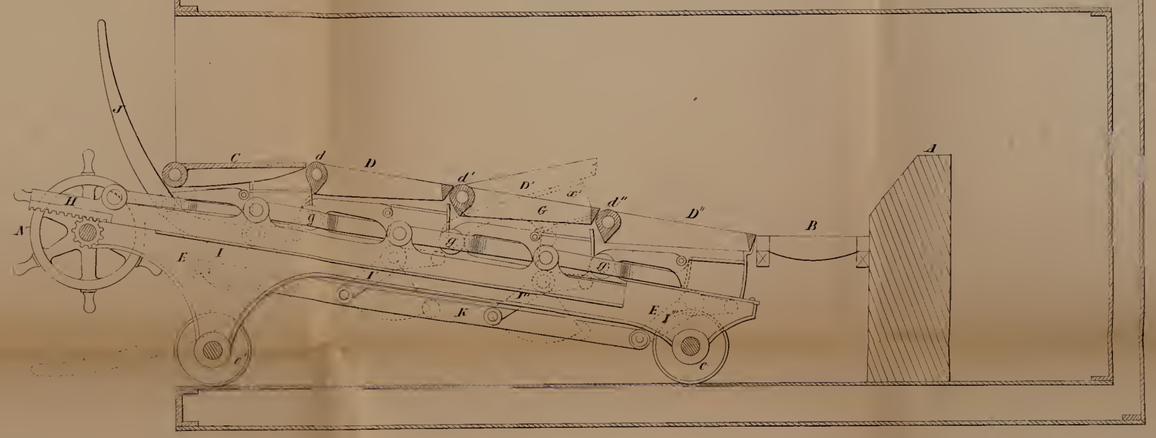

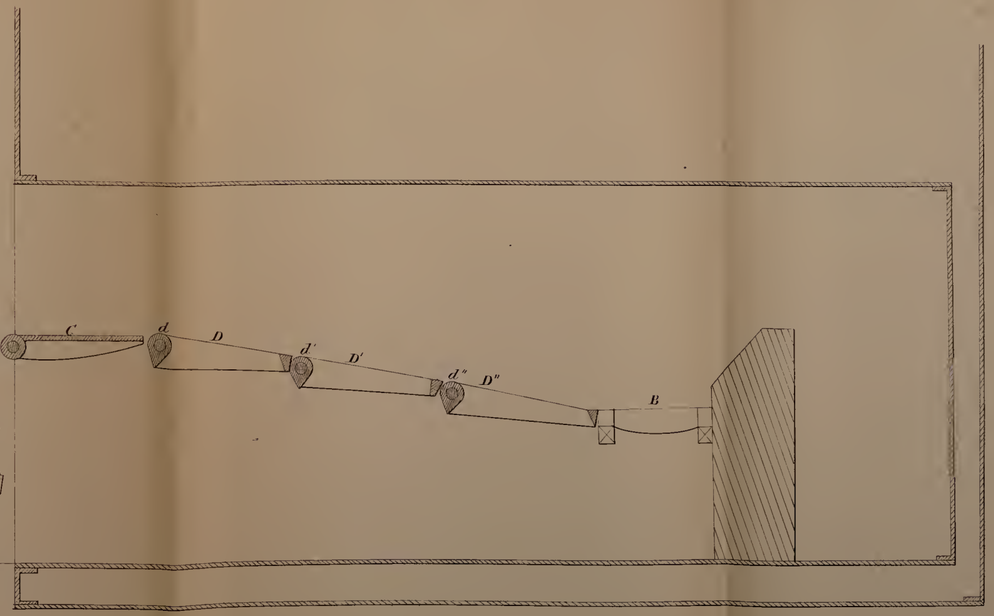

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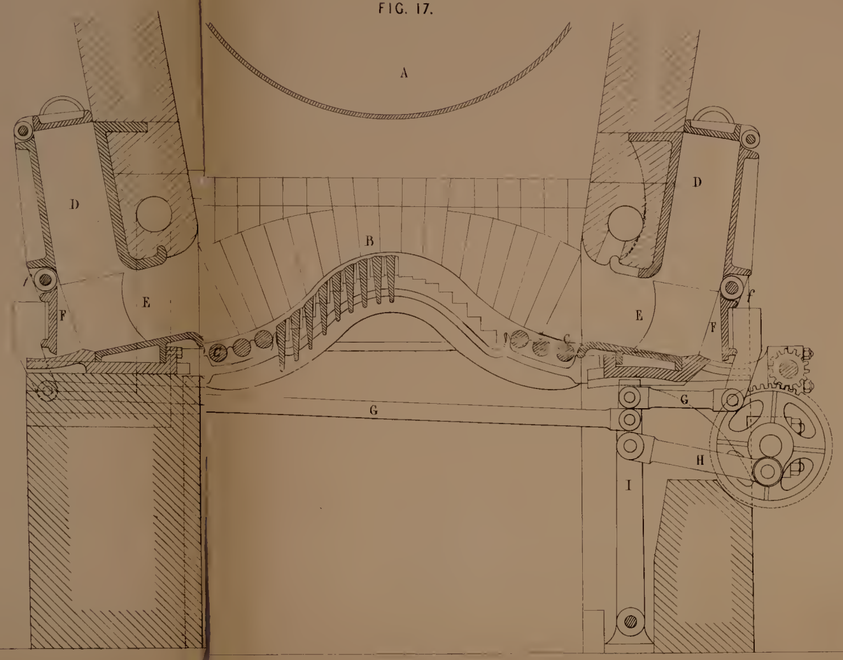
FIG. 17.



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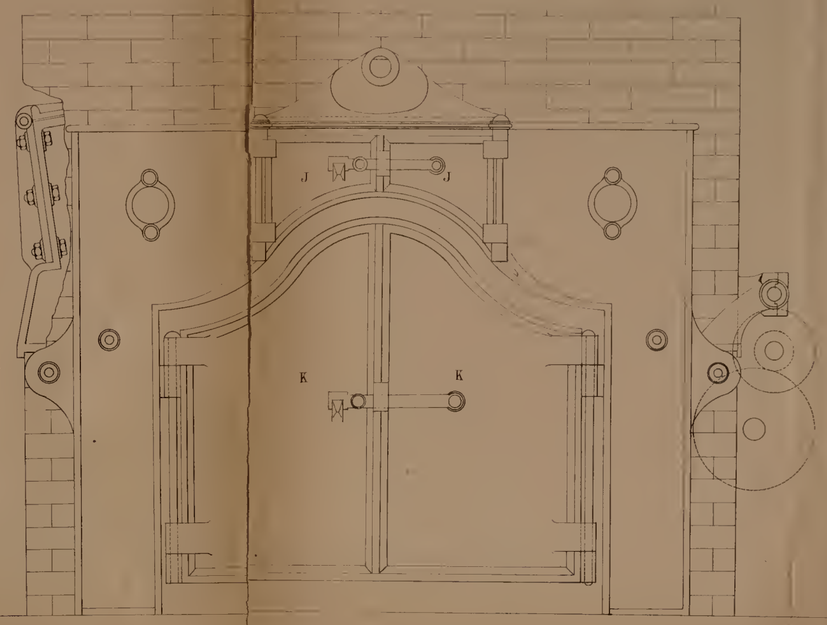
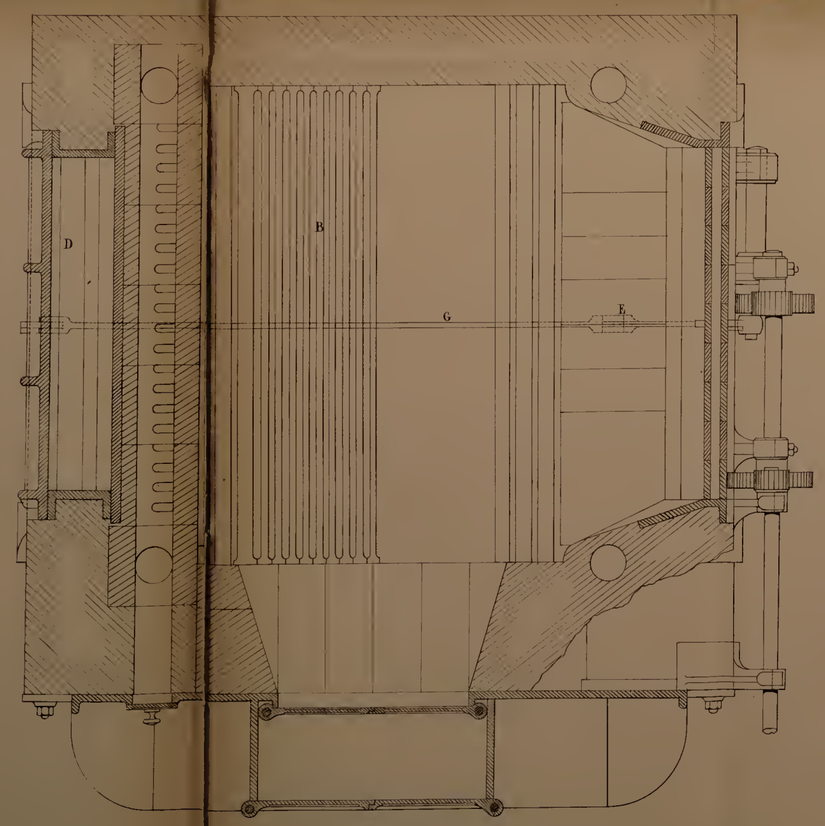


FIG. 18



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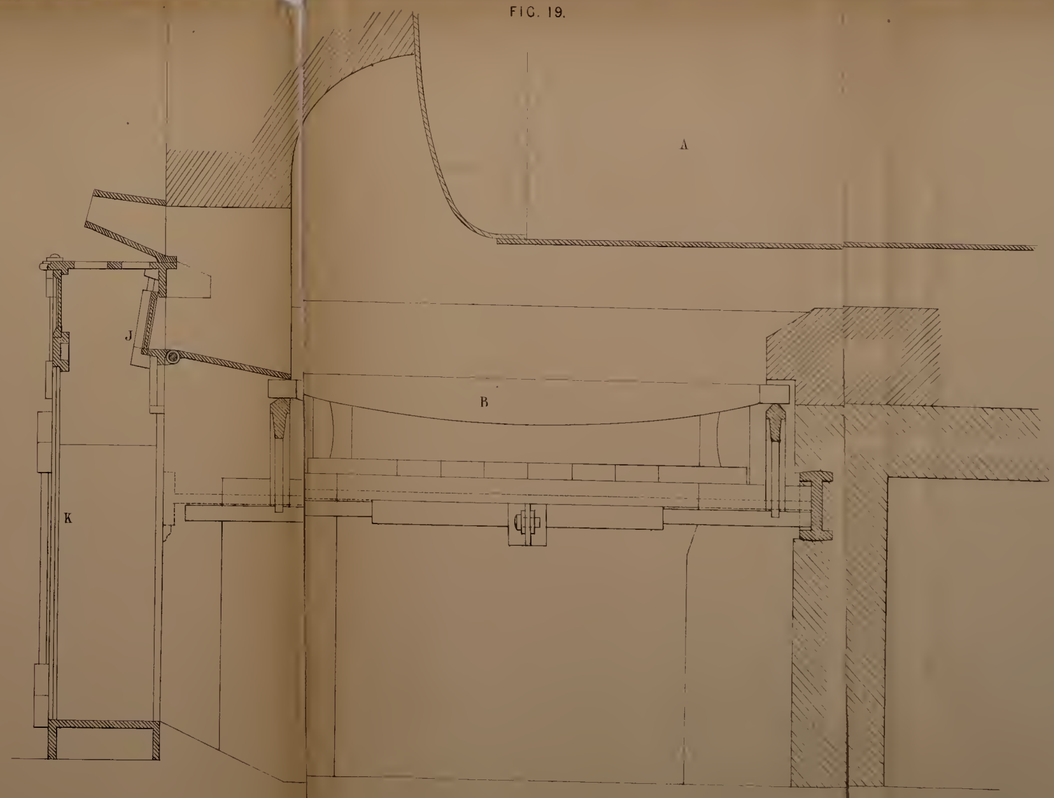

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